WHAT IS CLAIMED IS:

1. A non-invasive subject-information imaging apparatus comprising:

a light generating unit which generates light containing a specific wavelength component;

a light irradiation unit which radiates the light generated by the light generating unit into a subject to be examined;

waveguide means for guiding the light generated by the light generating unit to the irradiation unit;

a plurality of two-dimensionally arrayed electroacoustic transducer elements which convert acoustic waves from the subject into electrical signals;

transmission means for transmitting ultrasonic waves to the subject by driving said plurality of electroacoustic transducer elements;

reception means for generating a reception signal having reception directivity from said plurality of electrical signals converted by said plurality of electroacoustic transducer elements; and

signal processing means for generating volume data about a living body function by processing a reception signal corresponding to acoustic waves generated in the subject by light radiated from the irradiation unit, and generating volume data about a tissue morphology by processing a reception signal corresponding to echoes

generated in the subject upon transmission of the ultrasonic waves.

2. An apparatus according to claim 1, wherein

the waveguide means is formed from a plurality of optical fibers, and

the irradiation unit is formed from a plurality of end portions of said plurality of optical fibers,

said plurality of end portions being two-dimensionally arrayed.

3. An apparatus according to claim 2, wherein said plurality of electroacoustic transducer elements are vertically and horizontally arrayed with predetermined gaps therebetween, and said plurality of end portions of said plurality of optical fibers are discretely arranged in the gaps.

4. An apparatus according to claim 3, wherein each of said plurality of end portions of said plurality of optical fibers is surrounded by four electroacoustic transducer elements.

5. An apparatus according to claim 2, further comprising optical scanning means for sequentially irradiating the subject with light from said plurality of end portions of said plurality of optical fibers.

6. An apparatus according to claim 5, wherein the reception means generates a reception signal corresponding to acoustic waves generated by irradiation of the light, from electrical signals from a predetermined

number of electroacoustic transducer elements near an end portion of an optical fiber which has radiated the light.

7. An apparatus according to claim 2, further comprising optical scanning means for simultaneously radiating light beams from end portions of not less than two optical fibers whose end portions are spaced apart by not less than a predetermined distance.

8. An apparatus according to claim 7, wherein the reception means generates a reception signal corresponding to acoustic waves generated by irradiation of the light, from electrical signals from a predetermined number of electroacoustic transducer elements near an end portion of an optical fiber which has radiated the light.

9. An apparatus according to claim 2, wherein light beams are simultaneously radiated from said plurality of end portions of said plurality of optical fibers.

10. An apparatus according to claim 9, wherein the reception means generates a reception signal corresponding to an end portion of said each optical fiber, from electrical signals from a predetermined number of electroacoustic transducer elements near the end portion of said each optical fiber.

11. An apparatus according to claim 2, wherein photoacoustic scanning for generating volume data about

the living body function by irradiation of light from the end portion of the optical fiber and detection of an acoustic wave generated upon irradiation of the light by the electroacoustic transducer element and ultrasonic scanning for generating volume data about the tissue morphology by transmission of an ultrasonic wave by the electroacoustic transducer element and detection of an echo are alternately performed.

12. An apparatus according to claim 2, wherein irradiation of light from the end portion of the optical fiber which is performed to generate volume data about the living body function and transmission of an ultrasonic wave by the electroacoustic transducer element which is performed to generate volume data about the tissue morphology are alternately performed.

13. An apparatus according to claim 1, wherein the signal processing means generates living body function image data and tissue morphology image data about a single slice from volume data about the living body function and volume data about the tissue morphology.

14. An apparatus according to claim 13, wherein the living body function image data and the tissue morphology image data are displayed side by side on a single screen.

15. An apparatus according to claim 13, wherein the living body function image data and the tissue morphology image data are superimposed and displayed.

16. A non-invasive subject-information imaging method comprising:

irradiating a subject to be examined with light containing a specific wavelength component from a plurality of two-dimensionally arranged light irradiation positions;

causing a plurality of two-dimensionally arranged electroacoustic transducer elements to receive acoustic waves generated in the subject upon the irradiation of light;

driving said plurality of electroacoustic transducer elements to transmit ultrasonic waves in a plurality of directions corresponding to said plurality of light irradiation positions;

causing said plurality of electroacoustic transducer elements to receive echoes of the ultrasonic waves;

generating volume data about a living body function of the subject on the basis of a reception signal corresponding to the acoustic waves; and

generating volume data about a tissue morphology of the subject on the basis of a reception signal corresponding to the echoes.

17. A method according to claim 16, wherein the light is sequentially radiated from said plurality of light irradiation positions.

18. A method according to claim 16, wherein the

light is simultaneously radiated from said plurality of light irradiation positions.

19. A method according to claim 16, wherein the light is simultaneously radiated from a predetermined number of discrete light irradiation positions of said plurality of light irradiation positions.

20. A method according to claim 16, wherein the irradiation of light and the transmission of an ultrasonic wave are alternately performed.

21. A subject-information imaging apparatus comprising:

irradiation means for irradiating a subject to be examined with light;

ultrasonic wave transmission means for transmitting an ultrasonic wave to the subject;

electroacoustic conversion means for receiving an acoustic wave generated in the subject by the irradiation light or the transmission ultrasonic wave and converting the wave into an electrical signal;

first image data generating means for receiving an electrical signal output from the electroacoustic conversion means and generating first image data about a volume on the basis of an acoustic wave originating from the irradiation light;

second image data generating means for receiving an electrical signal output from the electroacoustic conversion means and generating second image data about

a volume on the basis of an acoustic wave originating from the transmission ultrasonic wave; and

display means for displaying the first image data and the second image data.

22. An apparatus according to claim 21, wherein the ultrasonic wave transmission means is partly commonly used as the electroacoustic conversion means.

23. An apparatus according to claim 21, wherein the display means displays the first image data and the second image data on a single monitor.

24. A subject-information imaging apparatus which irradiates a subject to be examined with light and an ultrasonic wave, receives acoustic waves generated in the subject by the light and ultrasonic wave, converts the waves into electrical signals, generates a plurality of image data about a single volume on the basis of the respective electrical signals, and displays the respective image data.

25. A subject-information imaging apparatus which irradiates a subject to be examined with light, receives an acoustic wave generated in the subject by the light, converts the wave into an electrical signal, generates image data about a volume on the basis of the electrical signal, and displays the image data.

26. A method of diagnosing breast cancer in humans, comprising the steps of:

a) bringing a diagnostic probe including

two-dimensionally arrayed ultrasound imaging elements and photoacoustic irradiation and detection elements in into contact with breast tissue;

b) irradiating the breast tissue with short duration light pulses having wavelengths within an absorption spectral band of hemoglobin to generate photoacoustic signals;

c) detecting the photoacoustic signal using ultrasound transducers to determine the distribution of vascularization of breast tissue;

d) generating and detecting an ultrasound image of the morphology of the human breast tissue by using ultrasound transducers together with the photoacoustic detection transducers used in the detection of the photo acoustic signals; and

e) overlaying the photoacoustic vascularization image over the ultrasound morphology image to generate a combined image of the vascular distribution in different morphological structures in the breast, the morphological structure being a target tumor.

27. A method of claim 26, wherein the wavelength of light falls within a spectral range between 530 nm and 1,300 nm.

28. A method of claim 26, wherein the photo-acoustic detection elements and the ultrasound detection elements are common.

29. An apparatus for diagnosing disease such as

breast cancer in humans by superimposing a distribution of the concentration of an analyte, such as hemoglobin over imaged morphological features such as tumors, comprising:

a) a light generating unit which generates light containing a specific wavelength component;

b) an irradiation unit which irradiates a subject to be examined with the light generated by the light generating unit;

c) waveguide means for guiding the light generated by the light generating unit to the irradiation unit;

d) first electroacoustic conversion means for converting acoustic waves generated in the subject by the light radiated by the irradiation unit into electrical signals by using a two-dimensional array of a plurality of electroacoustic transducer elements;

e) first image data generating means for generating first image data on the basis of the signals obtained by the first electroacoustic conversion means;

f) ultrasonic wave transmission means for transmitting ultrasonic waves into the subject;

g) second electroacoustic conversion means for converting components of the ultrasonic waves transmitted by the ultrasonic wave transmission means which are reflected inside the subject into electrical signals by using a two-dimensional array of a plurality

of electroacoustic transducer elements;

h) second image data generating means for generating second image data on the basis of the signals obtained by the second electroacoustic conversion means; and

i) display means for displaying the first image data and the second image data.

30. A subject-information imaging apparatus for determining a distribution of the concentration of an analyte, over imaged morphological features in tissue, comprising:

a light generating unit which generates light containing a specific wavelength component;

an irradiation unit which irradiates a subject to be examined with the light generated by the light generating unit;

waveguide means for guiding the light generated by the light generating unit to the irradiation unit;

first electroacoustic conversion means for converting acoustic waves generated in the subject by the light radiated by the irradiation unit into electrical signals by using a two-dimensional array of a plurality of electroacoustic transducer elements;

first image data generating means for generating first image data on the basis of the signals obtained by the first electroacoustic conversion means;

ultrasonic wave transmission means for

transmitting ultrasonic waves into the subject;

second electroacoustic conversion means for converting components of the ultrasonic waves transmitted by the ultrasonic wave transmission means which are reflected inside the subject into electrical signals by using a two-dimensional array of a plurality of electroacoustic transducer elements;

second image data generating means for generating second image data on the basis of the signals obtained by the second electroacoustic conversion means; and

display means for displaying the first image data and the second image data.